

108. (New) The superconductive method according to claim 107 in which oxygen is present in the copper-oxide compound in a nonstoichiometric atomic proportion. --

R E M A R K S

A. Summary of the Present Invention

The present invention broadly concerns superconductivity in a ceramic-like material having a superconductor transition temperature of about 26°K or greater. Preferred examples of such superconductive ceramic-like materials have a layer-type, perovskite-like crystal structure and an elemental composition of RE-AE-TM-O, where RE is a rare earth or rare-earth-like element, AE is an alkaline earth element, TM is a transition metal element, and O is oxygen.

B. Summary of the Most Recent Office Action in the Parent Case

In the most recent Office Action dated 25 April 1991 issued for the parent of the subject divisional application, the election with traverse of the claims of group I by the attorneys for the applicants was acknowledged. It was asserted that the restriction between the superconductive product, process of making, and method of use were directed to patentably distinct inventions. It was stated in effect that notwithstanding the

scope of certain process and method claims, the limitations in certain dependent claims distinguished the claims of groups I, II and III. It was held that the restriction requirement was deemed proper and was made final.

An objection in a prior Office Action dated 8 August 1990 to the specification and to claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive and 65 through 68 inclusive under 35 U.S.C. 112, first paragraph, was maintained. The specification was objected to under 35 U.S.C. 112, first paragraph, with the assertion that the specification failed to provide an enabling disclosure commensurate with the scope of the claims. The position of the applicants set forth in the previous response of 8 February 1991 that the scope of the claims as worded was reasonable and fully merited was noted, but not agreed with - with no comment on the basis for the position of the applicants set forth in their response. It was asserted that the claims of the application were so broad as to include a substantial number of inoperable compositions.

The rejection of claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive under 35 U.S.C. 112, second paragraph, was maintained with the assertion that the claims were indefinite for assertedly failing to particularly point out and

distinctly claim the subject which the applicants regarded as the invention.

The amended term "rare earth-like" was asserted to be vague. A position of the applicants that superconductive properties could be measured as the composition was varied was noted. It was stated that this position was unpersuasive assertedly because the claims of the subject application were so broad as to require an undue amount of experimentation.

In the most recent Office Action the term "doping" was asserted to be vague. It was asserted that neither the claim nor the specification discussed the limits of the effective amounts of doping.

It was asserted in the most recent Office Action that the expression "electron-phonon interactions to produce superconductivity" was not adequately explained in the specification.

It was asserted that the term "at least four elements" was indefinite considering the number of elements in the periodic table.

Claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through

68 were finally rejected under 35 U.S.C. 102(b) or in the alternative under 35 U.S.C. 103 as unpatentable over each of a publication by Shaplygin et al. in the Russian Journal of Inorganic Chemistry, volume 24, pages 820-824 (1979) ("the Shaplygin et al. publication"); a publication by Nguyen et al. in the Journal of Solid State Chemistry, volume 39, pages 120-127 (1981) ("the Nguyen et al. publication"); a publication by Michel et al. in the Materials Research Bulletin, volume 20, pages 667-671 (1985) ("the 1985 Michel et al. publication"); and a publication by Michel and Raveau in the Revue de Chimie Minerale, volume 21, pages 407-425 (1984) ("the 1984 Michel and Raveau publication").

The position of applicants that "no prima facie case has been made that the composition anticipates or renders obvious the subject matter" was noted. It was asserted that the materials appeared to be identical to those claimed except that the superconductive properties were not disclosed. It was asserted that the applicants had not provided any evidence that the compositions of the cited references were excluded by the language of the claim or that the materials were not superconductive. It was asserted that the composition claims of the subject application did not appear to exclude the materials. It was noted that it was the position of the applicants that under United States patent law they were entitled to claim compositions which might happen to overlap a portion of concentration ranges broadly

recited in the cited references. It was asserted that it was not understood how the claims of the subject application fell within the scope of the compositions disclosed in the prior art. It was asserted that the cited references disclosed specific compositions that assertedly not only fell within the scope of the claims, but assertedly appeared to be identical to the compositions disclosed in the specification as being superconducting. It was asserted that the materials were inherently superconductive and therefore rendered the claim unpatentable. The position of the applicants concerning "non-analogous art" was noted. It was asserted that for the composition claims of the present application, references directed to what assertedly appeared to be identical materials were relevant. It was stated that the cited individual disclosures appeared to be sufficient to maintain the rejection and that secondary references had not been relied upon to modify the teachings of the references.

Claims 1, 2, 5 through 11 inclusive, 40 through 44 inclusive, 46, 48, 51 through 54 inclusive, 60, 62, and 66 were finally rejected under 35 U.S.C. 102(b) or in the alternative under 35 U.S.C. 103 as unpatentable over a publication by Perron-Simon et al. in C. R. Acad. Sc. Paris, volume 283, pages 33 through 35 (12 July 1976) ("the Perron-Simon et al. publication"); a publication by Mossner and Kemmler-Sack in the Journal of the Less-Common Metals, volume 105, pages 165 through 168 (1985) ("the Mossner and Kemmler-Sack publication"), a

publication by Chincholkar and Vyawahare in Thermal Analysis 6th, volume 2, pages 251 through 256 (1980) ("the Chincholkar and Vyawahare publication"); a publication by Ahmad and Sanyal in Spectroscopy Letters, Volume 9, pages 39 through 55 (1976) ("the Ahmad and Sanyal publication"); a publication by Blasse and Corsmit in the Journal of Solid State Chemistry, volume 6, pages 513 through 518 (1973) ("the Blasse and Corsmit publication"); United States patent No. 3,472,779 to Kurihara et al. ("the Kurihara et al. '779 patent"); and a publication by Anderton and Sale in Powder Metallurgy No. 1, pages 14 through 21 (1979) ("the Anderton and Sale publication"). It was asserted that the rejection was maintained for the reasons set forth in the previous paragraphs. It was asserted that the references appeared to disclose materials which inherently provided superconductive properties and assertedly therefore rendered the present claims unpatentable.

C. Summary of the Present Amendments

With the filing of the subject divisional application, claims 1 through 23 inclusive, 27 through 85 inclusive, and 91 through 95 inclusive have been canceled without prejudice. Method claims 24 through 26 inclusive and 86 through 90 inclusive in the parent application previously withdrawn from consideration with traverse in response to a restriction requirement are now presented for examination in the subject divisional application.

In addition, new method claims 96 through 108 have been added by the present preliminary amendment.

New claim 96 is an independent claim directed to a superconductive method for causing electric-current flow in a superconductive state at a temperature in excess of 26 K. The claimed superconductive method comprises the step of providing a superconductor element made of a superconductive composition. The superconductive composition of the method of new claim 96 consists essentially of a copper-oxide compound which has a layer-type perovskite-like crystal structure and has a superconductor transition temperature T_c of greater than 26 K. The method of new claim 96 further comprises the step of maintaining the superconductor element at a temperature above 26 K and below the superconductor transition temperature T_c of the superconductive composition. The method of new claim 96 also comprises the step of causing an electric current to flow in the superconductor element. New claim 96 finds support in the parent application as filed, for example, at page 6, line 18 through page 7, line 8; page 7, lines 22 through 25; page 20, lines 2 through 21 together with Figure 1; and page 22, lines 16 through 22 together with Figure 4.

New claims 97 through 102 inclusive are dependent method claims which depend directly or indirectly on new claim 96.

New claim 97 is directed to the superconductive method according to claim 96 in which the copper-oxide compound of the superconductive composition includes at least one rare-earth or rare-earth-like element and at least one alkaline-earth element.

New claim 98 is directed to the superconductive method of new claim 97 in which the rare-earth or rare-earth-like element is lanthanum; new claim 99 is directed to the superconductive method of new claim 97 in which the alkaline-earth element is barium. New claims 97 through 99 find support in the parent application as originally filed, for example, at page 7, lines 5 through 22 and page 9, lines 3 through 15.

New claim 100 is directed to the superconductive method according to new claim 96 in which the copper-oxide compound of the superconductive composition includes mixed valent copper ions. New claim 101 is directed to the superconductive method of new claim 100 in which the copper-oxide compound includes at least one element in a nonstoichiometric atomic proportion. New claim 102 specifies that the copper-oxide compound of new claim 101 include oxygen in a nonstoichiometric atomic proportion. New claims 100 through 102 inclusive find support in the parent application as originally filed, for example, at page 11, lines 1 through 5 and 13 through 18.

New claim 103 is an independent claim directed to a superconductive method for conducting an electric current essentially without resistive losses. The method comprises the step of providing a superconductor element made of a superconductive composition which consists essentially of a copper-oxide compound having a layer-type perovskite-like crystal structure. The copper-oxide compound of the superconductive composition includes at least one rare-earth or rare-earth-like element and at least one alkaline-earth element. The composition has a superconductive/resistive transition which defines a superconductive/resistive-transition temperature range between an upper limit defined by a transition onset temperature T_c and a lower limit defined by an effectively-zero-bulk-resistivity intercept temperature $T_{\rho=0}$. The transition onset temperature T_c of the composition is greater than 26 K. The method of new claim 103 further comprises the step of maintaining the superconductor element at a temperature below the effectively-zero-bulk-resistivity intercept temperature $T_{\rho=0}$ of the superconductive composition. The method of new claim 103 also comprises the step of causing an electric current to flow in the superconductor element. New claim 103 finds support in the parent application as filed, for example, at page 6, line 18 through page 7, line 25; page 20, lines 2 through 21 together with Figure 1; and page 22, lines 16 through 22 together with Figure 4. Figure 4, for example, illustrates a superconductive/resistive transition for a preferred superconductive composition in which a resistivity

versus temperature curve exhibits a transition onset temperature of about 35 K and intercepts essentially zero resistivity at an effectively-zero-bulk-resistivity intercept temperature of about 13 K.

New claims 104 through 108 inclusive are dependent method claims which depend directly or indirectly on new claim 103. New claims 104 through 108 substantially parallel respectively new claims 98 through 102 and thus the comments above concerning support for new claims 98 through 102 in the parent application as originally filed apply analogously to new claims 104 through 108.

For the reasons set forth above, it is submitted that new claims 96 through 108 inclusive are fully supported by the parent application as originally filed and therefore do not constitute new matter.

D. The Rejections of the Most Recent
Office Action in the Parent Case

Each of the claims of the subject divisional application is directed to a method which includes a step of maintaining a superconductive material at a temperature in which the material is in a superconductive state. Thus, for example, independent claim 24 is directed to a method which includes the step in substance of maintaining the temperature of a transition metal

oxide at a temperature below a critical temperature of a phase in the transition metal oxide to produce a superconducting state in the phase - the critical temperature of the phase being greater than 26° K.

None of the Shaplygin et al publication, the Nguyen et al publication, the 1985 Michel et al publication, the 1984 Michel and Raveau publication, the Perron-Simon et al publication, the Mossner and Kemmler-Sack publication, the Chincholkar and Vyawahare publication, the Ahmad and Sanyal publication, the Blasse and Corsmit publication, the Kurihara et al. '779 patent and Anderton and Sale publication - each of which was cited against claims of the parent application in connection with a rejection under 35 U.S.C. Section 102 (b) or, in the alternative, Section 103 - disclosed or suggested superconductivity. For that reason, it is submitted that none of the citations just listed anticipates or renders obvious the subject matter of method claims 24 through 26 inclusive, 86 through 90 inclusive and 96 through 108 inclusive of the subject divisional application as amended. A rejection of any of claims 24 through 26 inclusive, 86 through 90 inclusive and 96 through 108 inclusive under either 35 U.S.C. Section 102 (b) or Section 103 would therefore be unwarranted.

With regard to the standards of 35 U.S.C. Section 112, first paragraph, the attorneys for the applicants submit that the claims of the subject divisional application as amended are fully

supported by an enabling disclosure and that the scope of the claims is reasonably correlated with the scope of enablement provided by the specification to those of ordinary skill in the art.

Concerning the standards of 35 U.S.C. Section 112, second paragraph, the attorneys for the applicants submit that the claims of the subject application are completely clear and definite and would readily be understood by a person of even only ordinary skill in the art.

The expression "rare earth-like element" questioned in the most recent Office Action of the parent application in connection with claim 1 of that application has been employed in claims 86, 97, 98, 103, and 104 of the subject application as amended. In the claims, the expression "rare earth-like element" appears as an alternative with the expression "rare earth element" in that the claims refer to "a rare earth or rare earth-like element." Different chemists evidently characterize different elements as "rare-earth elements." For example, Webster's Third New International Dictionary (Meriam-Webster, Springfield, Massachusetts, 1981) defines "rare-earth element" as:

any of the series of metallic elements whose oxides are the rare earths, which include the fourteen elements following lanthanum through lutetium with atomic numbers 58 through 71, usu. lanthanum itself, and according to some yttrium and even scandium

Thus the expression "rare earth-like" serves to clarify the intended meaning of "rare-earth element" in the context of the claims of the subject application - in that a person of ordinary skill in the art would understand, for example, that the elements lanthanum, yttrium, and scandium were to be included among the elements referred to as "rare earth or rare earth-like," as well as elements with atomic numbers 58 through 71. The expression "rare earth-like element" is discussed on page 7, lines 8 through 12 of the parent application as originally filed.

It is submitted that a rejection of any of the claims of the subject divisional application as amended under 35 U.S.C. Section 112, first or second paragraph, would be unwarranted.

E. Conclusion

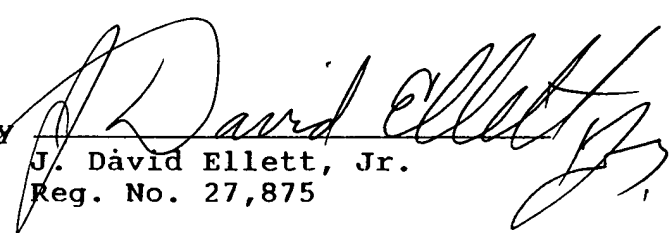
It is submitted that the claimed method of the subject divisional application as amended is neither disclosed nor in any way suggested by the art of record and that the claims of the application as amended fully meet the standards of 35 U.S.C.

Section 112, first and second paragraphs. Early allowance of the application is earnestly solicited.

Respectfully submitted,

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